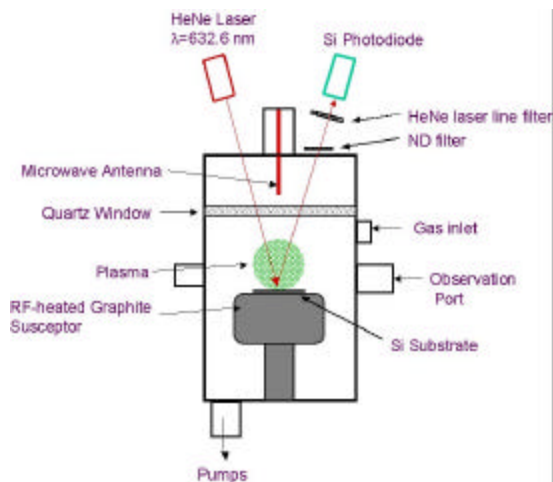
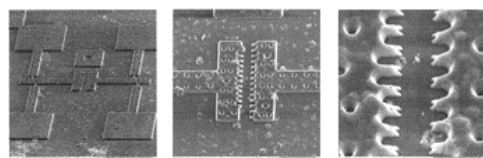


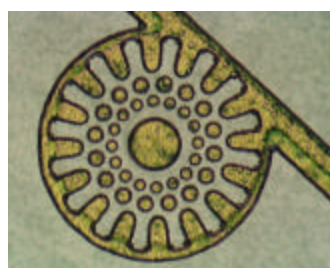
Studies of Mechanical and Tribological Phenomena in Ultrananocrystalline Diamond Thin Films



Microwave C_{60}/Ar or CH_4/Ar plasmas are used to produce UNCD films via C_2 dimers insertion in growing film lattice

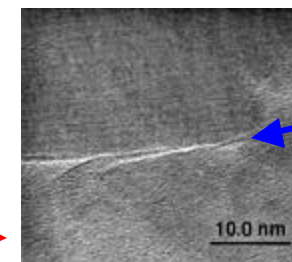
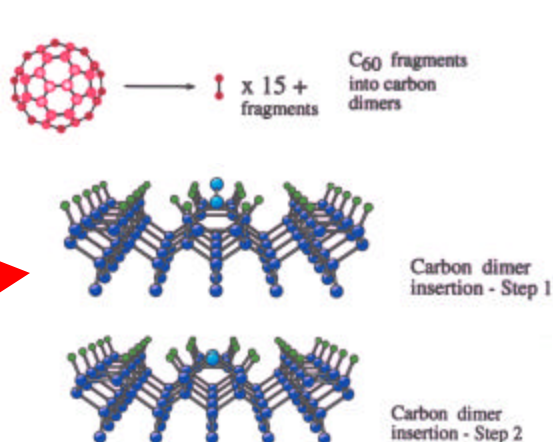


2-D UNCD MEMS gauge

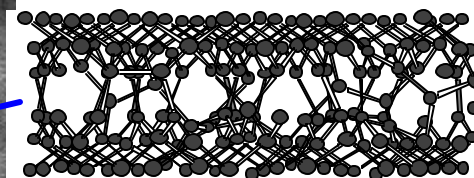


3-D UNCD MEMS microturbine

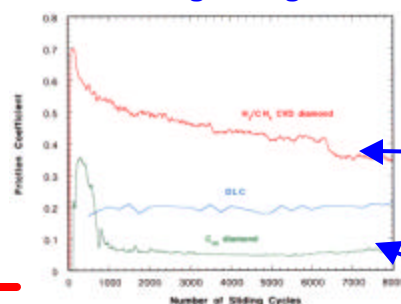
UNCD mechanical and tribological properties are ideally suited for a new UNCD-based MEMS technology



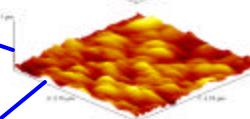
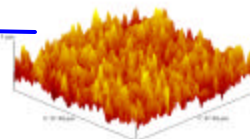
UNCD films are formed by 2-5 nm equiaxed grains and 0.2-0.5 nm grain boundaries



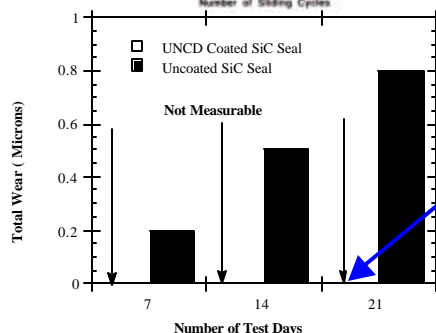
High-energy boundaries with some sp^2 bonded carbon are predicted by molecular dynamic simulation, providing the basis for the excellent mechanical properties of UNCD



Conventional CVD diamond film grown from H_2 (99%) - CH_4 (1%)

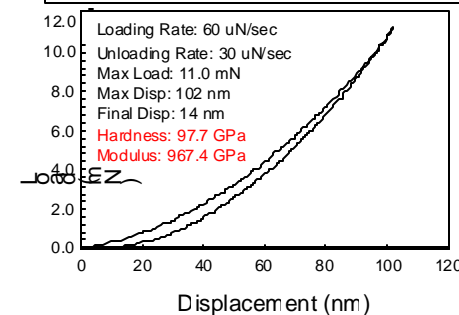


Nanocrystalline CVD diamond film grown from Ar (98%), H_2 (2%), C_{60}

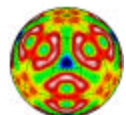


UNCD films are much smoother than MCD films, resulting in much lower friction coefficient and wear

Nano-indentation Load-Displacement for
ANL Ion Beam Polished UNCD Film
0% N_2 , Ar/ CH_4 = 99/1



UNCD films exhibit extremely High hardness (~97 GPa)



Basic Energy Sciences



ANL-MSD

Surface Chemistry Group (57504)
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